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CANADA AGRICULTURE

JOURNAL OF THE CANADA DEPARTMENT OF AGRICULTURE
JOURNAL DU MINISTÈRE DE L'AGRICULTURE DU CANADA

"Canada Agriculture" is published quarterly by the Canada Department of Agriculture. Its purpose is to help keep extension workers and agri-businessmen informed of developments in research and other federal agricultural responsibilities as carried on by the various units of the Department.

Contributors are invited to submit their articles in either English or French, and, following the policy used in "Research for Farmers", they will be published in the language of the author's choice.

Contributions should be addressed to the Secretary, Editorial Board, Information Division, Canada Department of Agriculture, Ottawa.

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Les articles soumis peuvent être écrits en anglais ou en français; suivant la politique établie dans «Research for Farmers», ils seront publiés dans la langue de l'auteur.

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"RESEARCH FOR FARMERS" ASSUMES A NEW LOOK

Beginning with this edition, *Research for Farmers*, now in its 11th year of publication, will be known as CANADA AGRICULTURE—Journal of the Canada Department of Agriculture, and will consist of 32 pages and cover instead of sixteen. This completes a transition in format which began a few issues back when a "new look" was introduced by way of new typography, more artistic layout, and offset printing.

Our new name, CANADA AGRICULTURE, opens the way to contributions from other Branches of the Department, although it was never intended that the Research Branch be the sole contributor to *Research for Farmers*.

The new title, CANADA AGRICULTURE—Journal of the Canada Department of Agriculture—is intended to embrace only the federal sphere of responsibilities in the agricultural industry. Articles reporting on results and objectives of the Research Branch program will be accorded the usual space, to be matched with contributions from the other Branches of the Department. Contributors are invited to submit their articles in either English or French and, following the policy used in *Research for Farmers*, they will be published in the language of the author's choice.

"RESEARCH FOR FARMERS" FAIT PEAU NEUVE

Avec le présent numéro, *Research for Farmers*, maintenant dans sa onzième année, devient CANADA AGRICULTURE—Journal du ministère de l'Agriculture du Canada. De 16 pages, il est augmenté à 32, à part la couverture. Cela complète les changements introduits il y a déjà quelque temps sous forme de typographie nouvelle, de présentation plus artistique et d'impression par offset.

La Direction de la recherche n'a jamais eu l'intention de monopoliser la contribution à *Research for Farmers* et espère que la nouvelle appellation CANADA AGRICULTURE fera encore mieux comprendre aux autres Directions du ministère que la porte leur est toute grande ouverte.

Le nouveau titre CANADA AGRICULTURE—Journal du ministère de l'Agriculture du Canada, ne couvrira que la sphère de responsabilités du gouvernement fédéral dans l'industrie agricole. On verra à agencer la mise en page de façon à conserver aux articles de la Direction de la recherche leur espace habituel et à assurer aux communiqués provenant des autres Directions l'espace qu'ils requièrent. Les articles soumis peuvent être écrits en anglais ou en français; suivant la politique établie dans *Research for Farmers*, ils seront publiés dans la langue de l'auteur.

NOTE TO LIBRARIANS

Volume 1 to Volume 11, Number 1, of this publication appeared as "Research for Farmers". Beginning with Volume 11, Number 2, this publication assumed the new title of CANADA AGRICULTURE—Journal of the Canada Department of Agriculture.

AVIS AUX BIBLIOTHÉCAIRES

Les Volumes 1 à 11, N° 1 de cette publication trimestrielle ont paru sous le nom de «Research for Farmers». Avec le Volume 11, N° 2, la publication s'appellera CANADA AGRICULTURE—Journal du ministère de l'Agriculture du Canada.

HOW TO OBTAIN FARM MACHINERY SYNDICATE LOANS

GEORGE OWEN

Farmers contemplating federal Farm Machinery Syndicate Loans should, first of all, take stock of their position by asking themselves the following six questions:

- Does the cost and upkeep of machinery take too large a share of your farm income?
- Do you take a big depreciation loss every year on machinery that is not used to capacity?
- Is the financing of additional or replacement machinery a major problem in maintaining a sound farm budget?
- Could you use a substantial portion of your present machinery investment for more productive purposes?
- Do you find that you cannot afford the machinery necessary for practical development of your farm?
- Does the lack of modern equipment:
  —result in a strain on the labour you have available,
  —prevent you from maintaining a strong competitive position in agriculture?

If your answer is "yes" to any of these questions and there are other farmers in your neighbourhood with similar problems who are willing to share machinery with you, it may be to your advantage to organize or join a syndicate for the purpose of obtaining the necessary machinery under the provisions of the FARM MACHINERY SYNDICATES CREDIT ACT.

IS SHARING MACHINERY PRACTICAL?

The cooperative use of farm machinery is not new. Generations of Canadian farmers have demonstrated their ability to share machinery for the purpose of cutting their overhead costs and improving their operating efficiency. More extensive sharing of this nature has been limited by inadequate credit facilities and the lack of acceptable plans for the organization of such groups on a simple and workable basis. The object of this legislation is to overcome these problems by providing the means for farmers to use their co-operative ability to improve their competitive position in a period of rapid change and rising costs.

WHAT ASSISTANCE IS AVAILABLE?

Under the Act, the Federal Government, through the Farm Credit Corporation, may lend a syndicate up to 80% of the cost of any machinery which can be

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Mr. Owen is Chairman, Farm Credit Corporation, Ottawa, Ont.

L-R: Liddon Vines, Neil and Dave McIntosh, Almonte, Ont., discuss machinery purchased with a loan under the Farm Machinery Syndicate Credit Act. FCC credit adviser Len Vickers, right.

used cooperatively by the members in the operation and development of their farms. A syndicate may borrow up to $15,000 per member or $100,000, whichever is the lesser.

WHAT WILL IT COST?

The interest rate will be kept as low as possible and will be based on the cost of funds to the Corporation and its expenses in servicing loans. (The rate currently in effect may be obtained from any Corporation office.) An initial charge of 1 per cent of the amount of each loan will be made at the outset to help cover the costs of making the loan.

WHAT IS A FARM MACHINERY SYNDICATE?

A farm machinery syndicate is a group of three or more farmers operating independently of one another or who are members of a cooperative farm association, the majority having farming as their principal occupation, and who have signed a written agreement for the joint purchase of farm machinery primarily for their own use. Before a loan can be approved the agreement must be acceptable to the Farm Credit Corporation.

WHAT ARE THE REPAYMENT TERMS?

Loans are repayable by the syndicate in equal annual or semi-annual instalments of principal plus interest over a period not exceeding 7 years. The term of repayment will depend upon the type of machine purchased and the extent to which it will be used. The Corporation will accept prepayment of all or any part of the loan at any time without notice or bonus.

WHAT SECURITY IS REQUIRED?

Loans will be secured by:

- A promissory note signed by all members of the syndicate which provides for joint and several liability for the amount of the loan.
- Additional security may be required in the form of a chattel mortgage on the farm machinery purchased, and such other security as the Corporation may require.

WHERE IS AN APPLICATION MADE?

Farmers interested in forming a farm machinery syndicate with the object of obtaining a loan should consult the Corporation's Farm Credit Advisor for their area. Since the organization of a syndicate will undoubtedly involve considerable planning and discussion between farmer members, they should initiate the formation of their syndicate well in advance of the date on which they require their machinery. Credit Advisor offices are conveniently located in agricultural centers across Canada and the address of the nearest office may be obtained from the appropriate Branch Office as follows:

BRITISH COLUMBIA—P.O. Box 249, Kerr Building, Kelowna, B.C.

ALBERTA—100 St. & 101A Ave., Edmonton, Alberta.

SASKATCHEWAN—1630 Albert St., Regina, Sask.

MANITOBA—P.O. Box 397, 235 Garry St., Winnipeg, Man.

ONTARIO—20 Eglinton Ave. East, Toronto 12, Ont.

QUEBEC—Place Laurier, Suite 410A-417, 2700 Laurier Blvd., Ste-Foy, Quebec 10, P.Q.

ATLANTIC PROVINCES—P.O. Box 849, 10 Alma St., Moncton, N.B.

An application must be made on a form provided by the Corporation and accompanied by agreements setting out the general and local terms under which the syndicate will operate.

ORGANIZING AND OPERATING A SYNDICATE

It is most important that farmers associate themselves in a syndicate with others with whom they can work in harmony and whose farming operations and needs are similar in nature to their own. This will provide a sound and workable base for the cooperative spirit so essential to the success of group ownership and operation of machinery.

A syndicate may originate in several ways *but most often it will start by one farmer recognizing that he has need for certain items of machinery, the cost of which does not justify full ownership.* He will endeavour to interest other farmers in a partnership arrangement to permit the joint purchase of machinery they can use to their mutual advantage. When three or more farmers have tentatively agreed on the composition and purpose of the syndicate they are then in a position to present their proposition to the Corporation preparatory to making a loan application.

BASIC OPERATIONAL REQUIREMENTS

Sharing arrangements work best and the interests of individual members are safe-guarded if a firm and business-like understanding is established at the beginning. To avoid the risk of misunderstanding between members the Act requires that the basic provisions of an agreement receive the approval of all members.

Certain aspects of joint operations are common to all syndicates, such as the procedure for adding new members, a reduction in membership, the appointment of officers and the keeping of accounts and records, etc.

There are also local arrangements to be agreed upon by the members covering such matters as the sharing of capital and maintenance costs, the order of machine use by members, repair and storage arrangements, etc. This local agreement may be amended from time to time by resolution at the discretion of the syndicate.

Where the membership in a syndicate is limited in number, the terms of the local agreement may be quite simple and straight forward. With a larger membership and a greater variety of equipment more detailed provisions may be required.

A SYNDICATE EXAMPLE

The following example illustrates how a syndicate formed for the purpose of obtaining credit under this legislation may be of benefit to a group of farmers:

Three farmers each operating a livestock, forage crop and grain program decide that their operations permit them to profitably share the use of a forage harvester and other matched forage handling equipment costing a total of $6,000. Based on the feed to be handled on each farm, farmer "A" will require its use 50% of the time, farmer "B" 30% and farmer "C" 20%. They agree in advance that all payments they will make towards the capital investment in this equipment will be made in these proportions. (They may make different arrangements to cover operating costs according to the specific circumstances under which they will operate.) Thus, the $1,200 down payment will be allocated $600 to farmer "A", $360 to farmer "B" and $240 to farmer "C".

They agree to apportion the remaining capital cost of $4,800, spread over 7 years, on the basis of $2,400 to farmer "A", $1,440 to farmer "B" and $960 to farmer "C".

The following are some of the advantages resulting from this sharing arrangement:

- Each farmer will be able to mechanize his forage harvesting operations at a reduced capital and maintenance cost.
- More intensive use may be made of machinery to cut down the depreciation borne by the individual farmer.
- Financing is on terms that will permit each farmer to divert a greater portion of his annual investment dollar to other productive purposes.
- By exchanging labour they can avoid hiring additional help.
- Since these farmers, individually, may not have been able to consider such a purchase, the improvement in mechanization will go a long way towards maintaining their family farms in a strong competitive position.

Although the foregoing example applies only to one class of machinery there is a wide range of machinery used for farm development and operation that satisfactorily lends itself to cooperative use.

The Corporation is prepared to give guidance and assistance to any group of farmers in organizing and in financing the operation of a syndicate. As of March 10, 1966, 132 loans, involving 117 syndicates comprising 492 members, were approved under the F.M.S.C. Act, totalling $966,028. •

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150 rue Kent
Ottawa

H. B. WRESSELL

ROOTWORMS

The northern corn rootworm, *Diabrotica longicornis* (Say), which is a close relative of the cucumber beetle, is now a major pest of grain corn in southwestern Ontario. It is only a pest, however, where corn is grown as a continuous crop; that is, on the same land for several successive years. This type of farming has increased greatly in recent years because of changed cultural methods and ready markets.

The corn rootworm has always been present in corn-growing areas, but in relatively unimportant numbers. It is thought to be specific to corn, although it will survive precariously on some grasses. It is evident, then, that this insect is unable to thrive wherever rotation farming is followed. This is important; it means that only growers of continuous corn need be concerned with controlling this pest.

Damage is chiefly done by larvae feeding on roots during early summer. This causes plants to lean or lodge because of a weakened root system. After the brace roots appear, this leaning is arrested and growth is more normal. A peculiar effect, however, is pro-

The author is an entomologist with the CDA Entomology Laboratory, Chatham, Ont.

Corn rootworm damage to silk.

Pest feeds on ear of corn.

Damaged ("goose-necked") stalks showing poor root systems.

duced; this is called 'goose-necking'. About the time grain corn matures, seasonal high winds are prevalent in southern Ontario, and serious lodging occurs in fields severely attacked by rootworms. Studies at the CDA Entomology Laboratory, Chatham, show that lodging may exceed 50 per cent of the crop, and yields may be reduced by 25 per cent at harvest. These figures are based on study plots and not large acreages.

The greenish beetles appear in numbers when silking begins in the field. They feed on the silks and, when numerous, sometimes crop them very close. If pollen is shed over a short period and dry weather retards the growth of silk after cropping, germination is affected and barren ears occur. This is generally not serious but it was particularly noticeable in 1964 and 1965 when semi-drought conditions occurred.

Studies at Chatham have demonstrated that systemic insecticides, such as phorate and Di-Syston, are very effective against the rootworm. Diazinon is also a useful material, but in a dry season its effectiveness is lessened considerably. The organic chlorines, aldrin and heptachlor, have always given excellent control but are known to leave long-lasting residues in the soil. The amount of insecticide used varies according to the soil type. On sandy loam, one-half pound of active ingredient is enough, but on heavier clay soils about twice this amount is required.

Granular formulations are preferable to liquid, but either may be used. A special applicator is mounted on the corn planter, and the insecticide is applied as a narrow band immediately behind, but not in contact with, the seed. In our investigations, we have found that the chief damage by the rootworm is done near the plant itself. For this reason, broadcast applications are not recommended; in addition, twice the amount of material, or more, would be needed. This is costly and wasteful, and increases residues in the soil.

Further testing of newer systemic materials for rootworm control is contemplated, with consideration being given to residue build-up in soils. Further, a study of the possible use of resistant hybrid corn varieties will be developed, although such a study must be long-range in outlook. The corn rootworm is an insect that can be controlled very easily—by crop rotation. Many growers are not interested in this method, however, so long as prices for corn remain high. Whether the rootworm will increase to the point where farmers are forced into this kind of control remains to be seen. •

INVADE ONTARIO'S CORN BELT

THIS INDUSTRY

S. W. GARLAND AND
MARY A. BRADLEY

The agricultural industry is an important part of our economy because of its size and its contributions to other sectors of the economy, and also, and chiefly because it supplies Canadians with essential foodstuffs. Science and technology have changed and are continuing to change the character of our agriculture. Farms are becoming fewer in number, larger in area, more mechanized, more highly capitalized, and have an increasing degree of interdependence with other industries. It is a complex, decentralized and segmented entity that is almost impossible to describe statistically.

THE PRIMARY INDUSTRY.—Our primary agriculture covers a land area of 173 million acres, including 103 million acres of improved land:

63 million acres are in crops,
10 million in improved pasture,
28 million in summerfallow, and
2 million acres are used for other purposes.

In 1961 there were 480,903 farms, on which lived 2,128,400 people or 11.7 per cent of our total population.[1]

The capital value of all farms was estimated at $13.2 billion, including:

land and buildings,	$8.6 billion
machinery and equipment	$2.6 billion
livestock and poultry,	$2.0 billion

The average capital investment per farm unit was:

total	$27,388
land and buildings	$17,930
machinery and equipment	$ 5,341
livestock and poultry	$ 4,117

Agriculture's share of the Gross Domestic Product has been about 5.5 per cent in recent years. In 1963-64, agriculture's contribution averaged $2.2 billion out of an average total Gross Domestic Product of $39.9 billion.

INCREASING PRODUCTIVITY.—One of the most significant features of the Canadian agricultural industry has been the continued increase in production with a decreasing labor force. The labor force in agriculture has declined from 1.2 million in 1946 to 630,000 in 1964. During this period the physical volume of agricultural production increased over 40 per cent.

THE FARMER AS A BUSINESSMAN.—In common with other businessmen, farmers pay taxes,

Economists, Economics Branch, Canada Department of Agriculture, Ottawa.

[1]While these were the figures at the time of the 1961 census, unofficial estimates indicate that there has been a considerable reduction in the number of farms since then.

OF AGRICULTURE

interest, rent, wages of hired labor, and make capital expenditures. In 1964 farmers paid:

real estate taxes	$169	million
rent	$ 85	million
interest on indebtedness	$ 92	million
wages of hired labor	$222	million

Capital expenditures

construction	$197	million
machinery and equipment	$577	million

Purchases of new farm machinery in 1964 included:

27,722 tractors and engines,
9,774 grain combines,
12,027 hay balers,
9,039 swathers,
1,792 forage crop harvesters,
10,020 side delivery rakes,
1,097 hay conditioners,
12,412 mowers,
7,906 manure spreaders,
9,715 moldboard ploughs,
6,541 diskers,
15,480 cultivators.

THE AGRICULTURAL INDUSTRY AS A CONSUMER.—The primary agricultural industry is a large consumer of goods and services produced by other sectors of the economy. Farm production expenses in 1964 included:

feed and seed	$374	million
repairs and operating costs of farm machinery	$538	million
fertilizer and lime	$126	million
pesticides, fruit and vegetable packaging materials	$ 42	million
building repairs	$119	million
electric power	$ 24	million
miscellaneous expenses	$166	million

Depreciation allowances for buildings and machinery were estimated at $349 million.

A CREATOR OF EMPLOYMENT IN OTHER INDUSTRIES.—Thousands of people have jobs storing, processing, transporting, and merchandising the products of agriculture. Thousands of others have jobs providing the supplies farmers use in their production operations.

Many of the jobs previously done by farm workers are now done by urban workers. For example, preparation of feed formerly was done largely on farms but is now done chiefly in non-farm feed mills. The farm-raised horses that formerly furnished power have been replaced almost entirely by industrially-produced tractors, trucks, and automobiles.

Of 33,430 manufacturing industries in 1962, 7,680 were in the foods and beverages group. This group employed 210,156 workers and paid $816.8 million in wages.

Statistics of some of the leading industries processing agricultural products in 1962 are:

slaughtering and meat packing—249 plants, 25,823 employees, $120.0 million paid in wages.

miscellaneous food manufacturers—279 plants, 12,337 employees, $52.5 million paid in wages.

pasteurizing plants—771 plants, 21,208 employees, $85.4 million paid in wages.

bakeries—2,628 plants, 31,931 employees, $113.0 million paid in wages.

butter and cheese plants—889 plants, 7,619 employees, $24.0 million paid in wages.

fruit and vegetable canners and preservers—340 plants, 18,258 employees, $59.7 million paid in wages.

feed manufacturers—920 plants, 8,217 employees, $30.6 million paid in wages.

breweries—50 plants, 8,996 employees, $51.3 million paid in wages.

tobacco products manufacturers—23 plants, 9,093 employees, $41.3 million paid in wages.

flour mills—55 plants, 4,265 employees, $18.3 million paid in wages.

Producers of petroleum products, building materials, electric power, fertilizer, farm machinery, automobiles, trucks, paper, twine, chemicals and pharmaceuticals, rely on agriculture as a market for all or part of their production.

In 1962 the farm machinery industry in Canada consisted of 70 plants, with 7,331 workers. Wages paid totalled $34.9 million. The fertilizer manufacturing industry consisted of 45 plants with 950 workers. They paid $3.9 million in wages.

A SOURCE OF FOREIGN CURRENCY.—Sales of agricultural products abroad are a source of foreign currency to purchase foods and other goods not produced in Canada. In recent years, the value of agricultural products exported has been one-fifth of the value of exports of all commodities.

Agricultural products exported in 1964 were valued at $1.7 billion. Values of some major groups were:

grains, other than seeds	$ 1.1	billion
grain products for human food	$118.2	million
oilseeds and oilseed products	$ 96.9	million
meats	$ 51.5	million
dairy products	$ 61.0	million
other animal products	$ 70.8	million
poultry and eggs	$ 3.0	million
fruits and nuts	$ 21.9	million
vegetables	$ 17.9	million
potatoes	$ 12.4	million
raw tobacco	$ 37.8	million

FARMING IS FOOD PRODUCTION.—The modern Canadian food store carries a wide variety of food products. In addition the foods may be in many forms.

They may be fresh, canned, frozen, concentrated, dehydrated, ready-mixed, pre-cooked, and ready-to-serve.

The following is the estimated average consumption of some food items by Canadians in 1964:

beef, veal, lamb, and pork	149.4	pounds
poultry meats	34.5	pounds
eggs	21.5	dozen
dairy products (fluid milk equivalent)	912.2	pounds
cereals (excluding breakfast foods)	138.8	pounds
potatoes (fresh equivalent)	157.1	pounds
sugars and syrups (sugar content)	105.7	pounds
fats and oils	50.9	pounds
fruits, including tomatoes (fresh equivalent)	230.2	pounds
vegetables (excluding tomatoes) (fresh equivalent)	105.4	pounds

A FOOD BASKET FOR THE WORLD.—Canada is one of the major sources of food supplies for both industrially developed countries and newly developing countries. Cereals, cereal products, seeds for sowing, livestock and livestock products, poultry and poultry products, fruits and vegetables are exported throughout the world.

Some exports in 1964 were:

wheat	497.9 million bushels
wheat flour	1.1 million tons
flaxseed	14.8 million bushels
cattle	223,000 head including 23,000 head of purebreds
cheese	31.7 million pounds
fresh apples	3.2 million bushels
turnips	92.4 million pounds
seed potatoes	134.5 thousand tons

seeds for sowing, excluding seed potatoes, valued at $18.7 million.

CONSUMER EXPENDITURES ON FOOD.—Despite increasing costs for services associated with the food products purchased by the consumer, expenditure on food is a smaller percentage of the consumer's disposable income than a decade ago. In 1954, consumers spent 23.7 per cent of their disposable income on food, but in 1964 the proportion had dropped to 21.2 per cent.

THE FARMER'S INCOME.—Farmers received about $3.4 billion from sales of crops and livestock in 1964. In addition they sold products from their farm woodlots valued at $31.9 million. Realized net farm income was estimated at $1.5 billion. Farm families received an average of about $3,800 per family, for their labour and the capital invested in the farm business. •

new food analytical control laboratories

A. H. JONES

The Food Analytical Control Laboratories are in new quarters in the Plant Products Building, Ottawa. The new set-up consists of a series of laboratories with supporting wash-up, preparation and sterilization facilities. The laboratory concerned with the analysis of cheese for extraneous matter, previously situated in the Dairy Building, is also included in the new set-up but remains under the control of the Dairy Products Division. No change was made in the existing dairy chemical laboratory situated immediately adjacent to the new laboratories.

At these laboratories a staff of 18 technicians analyse as many as 20,000 samples of food products each year. All samples are submitted by Inspectors of the Department's Production and Marketing Branch. The products analysed include butter, cheese, milk powder and other manufactured dairy products, frozen egg melange, egg powder, processed tomato products, frozen vegetables, dehydrated and freeze-dried vegetables, edible gelatin, honey, pickles, jams, maple syrup and meats. The emphasis of these analyses is on grade standards to conform with established standards under Government Acts and Regulations. These standards are designed to maintain and improve the quality of products both for the domestic and export markets.

Considerable attention is also given to enteric-type bacteria. These may reflect the sanitary precautions observed in processing, and in the detection of potential food-poisoning microorganisms, in such products as milk, egg and vegetables.

The cheese laboratory with a staff of 4 examines approximately 80,000 samples of cheese each year for extraneous matter.

During periods of the year (January-April), when the pressure of routine analyses is not as great, the staff of the microbiological and dairy chemistry laboratories are used on research projects relating to methods of analyses. Many of the present methods have been in use for as long as 20-30 years. It is of utmost importance that as older methods are improved or new methods developed that they be tested and evaluated at these laboratories. This year 6 major projects are in progress:

1. A study to determine the validity of the direct microscopical bacteria count (DMC) for milk powder. Results to date indicate that the DMC method, within certain limits, provides a more

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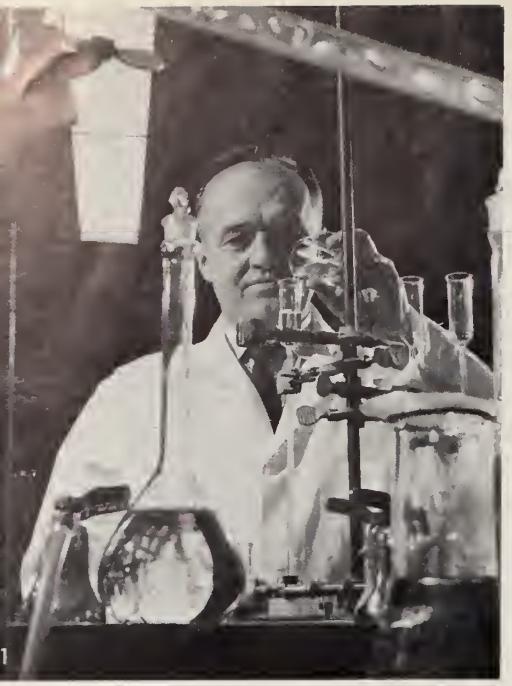
Dr. Jones is supervisor of the Food Analytical Control Laboratories, Plant Products Division, CDA Production & Marketing Branch, Ottawa, Ont.



1—Chemical analysis.

2—Powdered milk analysis, titrating for acidity (background).

3—Majonnier machine and balance wheel used in analysis of dairy products.

4—Direct microscopical count (DMC) for milk powder.

5—Egg melange being prepared for salmonella analysis.

6—Analysis for extraneous matter in cheese.

accurate assessment of quality of the initial liquid milk than the plate count method.

2. A study of variables in the determination of the moisture content of butter. Studies to date have shown that the old idea of submitting a small portion of a pound print of butter for moisture determination gives erroneous results; larger aliquots are necessary and the method of preparing the butter sample for analyses has a profound influence on the results.
3. The incidence of salmonella, streptococci and coloform bacteria in egg products. This project is designed to determine the sanitation of the processing of these products and the detection of potential food poisoning organisms.
4. Microbiological assays of animal feeds for antibiotics. This is a new field of analysis for this laboratory. The analyses will be concerned with the detection of antibiotics and their potency.
5. Improved methods for the analysis of frozen vegetables. This is a continuing project designed to produce results in a shorter period of time. Studies have shown that the Burri tube technique is a reliable method as a preliminary screening test for samples of products and results are available 24 hours earlier than by the conventional plate method. This year's studies are concentrated on improvements in sampling techniques for microbiological analyses.
6. The latest methods of the American Public Health Association recommend a 48-hour incubation period for nutrient agar plates from milk powder replacing the 72-hour period previously recommended. Collaborative studies with other laboratories and studies within our own laboratory have shown that the 48-hour incubated plates are either not countable due to insufficient development of colonies or the counts are significantly lower than the 72-hour plates. In an effort to obtain a 48-hour count, this laboratory is studying the effect of surface inoculation compared with the conventional poured plate and varying the composition of the medium to effect a faster rate of growth for bacteria.

Similar routine analyses are conducted by the Plant Products Division in a laboratory at Calgary, Alta., and by the Food and Drug Laboratories of the Department of National Health and Welfare, Toronto, Ont. Microbiological analyses of frozen vegetables and chemical tests on apple juice are carried out by the Department's Fruit and Vegetable Division in a laboratory at Kentville, N.S. •

NOUVELLES VARIÉTÉS DE POMMES HÂTIVES

LLOYD P. S. SPANGELO

Quinte, Ranger, Caravel . . . trois nouvelles variétés de pommes hâtives créées à la Ferme expérimentale centrale, Ottawa. Supérieures aux variétés cultivées à l'heure actuelle, dans l'Est du Canada, pour le marché des primeurs. Ont donné de bons rendements au cours d'essais pratiqués dans divers vergers commerciaux depuis le sud-ouest de l'Ontario jusqu'en Nouvelle-Écosse. Mûrissent plus tôt que la Melba et semblent aussi rustiques que la McIntosh.

Les pommes hâtives n'ont qu'un marché limité à cause de leur courte durée de conservation à l'étalage; il y a cependant place pour des variétés améliorées mûrissant plus tôt que la Melba.

Ces nouvelles variétés mûrissent plus tôt et se prêtent mieux au transport que la Melba. Comme pommes de couteau (à dessert) elles sont supérieures à la Crimson Beauty et à la Close. La Quinte possède à un haut degré les qualités requises pour l'expédition. Dans l'Est, c'est la Quinte qui a donné les meilleurs résultats, suivie de la Ranger; la Caravel s'est classée bonne dernière. C'est en Nouvelle-Écosse que la Caravel a donné son meilleur rendement. Les trois variétés se prêtent aux étalages montés le long des routes dans les régions à pommes au Canada.

Pomologiste, Station de Recherches d'Ottawa, Ont.

REMERCIEMENT

L'auteur désire rendre hommage à feu M. D. S. Blair qui a choisi les variétés Ranger et Caravel et effectué les épreuves préliminaires.

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LA RANGER

La Ranger (0-342 en 1944) mûrit trois ou quatre jours après la Crimson Beauty et sept à dix jours avant la Melba. On doit faire au moins deux cueillettes. Le fruit, plus gros que celui de la Caravel, se compare à la Melba pour la saveur.

Caractéristiques—Fruit rond-conique; cavité large mais moyennement profonde; cuvette large et moyennement profonde; chair blanche et tendre; pelure jaune, abondamment lavée et rayée de rouge attrayant; sous des conditions favorables de croissance, environ 75 p. cent de la pelure devient rouge. L'arbre rustique et vigoureux produit tous les ans.

L'angle de la fourche est aigu; il faut donc procéder avec précaution lors de la taille.

La Ranger a été choisie entre les variétés issues du croisement de la Crimson Beauty par la Melba.

La Ranger

LA QUINTE

La Quinte (T-441 en 1954) mûrit trois ou quatre jours après la Crimson Beauty et sept à dix jours avant la Melba. Les fruits n'arrivent pas à maturité tous à la fois; la première cueillette de pommes Quinte et Ranger a lieu à peu près en même temps. On fait par la suite, au moins deux autres cueillettes de Quinte, au fur et à mesure que les fruits mûrissent.

Comme pomme à couteau, elle est égale à la Melba et supérieure à la Ranger et à la Caravel. C'est une petite pomme et il peut être nécessaire, en certains endroits, d'éclaircir les fruits afin d'obtenir des pommes de bonne grosseur.

Caractéristiques—Fruit rond à légèrement conique; cavité moyenne et assez profonde; cuvette étroite et plus profonde que celle de la Ranger: chair crème et très tendre; pelure jaune abondamment lavée de rouge attrayant; sous des conditions favorables de croissance, environ 80 p. cent de la pelure devient rouge.

L'arbre semble aussi rustique que le pommier McIntosh et croît à la manière du Melba mais il produit tous les ans.

La Quinte provient, par voie de sélection, des variétés obtenues du croisement de la Crimson Beauty par la Melba (lignée Pate), à la Ferme expérimentale de Smithfield (Ontario).

LA CARAVEL

La Caravel (0-277 en 1942; aussi connue sous le nom de Portia) mûrit trois ou quatre jours avant la Melba et doit être cueillie à deux ou trois reprises au moins. En tant que pomme de couteau et pour la saveur, elle est supérieure à la Crimson Beauty et presque égale à la Melba.

Caractéristiques—Fruit rond-conique; cavité large et profonde; cuvette large et peu profonde; chair crème et tendre; pelure jaune abondamment lavée de rouge; sous des conditions favorables de croissance environ 65 p. cent de la pelure devient rouge brillant.

L'arbre est rustique, se développe comme le pommier Melba et porte des fruits tôt. Il produit tous les ans. Les fruits très nombreux doivent être éclaircis afin qu'ils puissent atteindre la grosseur désirée par le consommateur.

La Caravel a été choisie entre les variétés issues du croisement de la Melba par la Crimson Beauty. •

La Quinte

La Caravel

NITROGEN—THE APPLE GROWER'S DILEMMA—Nitrogen may be regarded as the balance wheel in the nutrition of the apple tree. The widespread adoption of leaf analysis has enabled the grower to reach more reliable decisions on proper fertilizer application.

In a 6-year survey conducted by the CDA Research Station, Kentville, N.S., of 15 commercial orchards in the Annapolis Valley to study the nutrient content of McIntosh apple leaves, we found that nitrogen levels above 2.2% were associated with green apples and below 1.9% with small, highly colored fruits. The dominating influence of nitrogen has also been demonstrated in a cultural experiment with McIntosh trees at the Kentville Research Station. Continuous clean cultivation has resulted in high concentrations of nitrogen in the tree. In contrast, trees growing in grass, but receiving equivalent amounts of fertilizer, showed symptoms of nitrogen starvation.

While clean cultivation favors better utilization of applied nitrogen, it also causes a depletion of organic matter in the soil, with an attendant reduction in its water-holding capacity .The use of grass sod culture will maintain organic matter but deprives the tree of nitrogen and also of water. This can be remedied by using additional fertilizer and by mulching. Before recommendations based on leaf analysis are made, the analytical data must be related to tree performance and cultural practices.

More recently, as an alternative to leaf analysis, we have been using the juice of the apples, and have found that its chemical content is closely related to that found in the leaves. The technique is relatively simple, and we believe has possibilities as a supplement to other methods now in use.

A high nitrogen content in the orchard encourages core browning, a fruit disorder that, under cold storage conditions, limits the storage life of the apple. This usually required the rapid disposal of McIntosh apples in late January at unprofitable prices. However, the development of controlled atmosphere storage containing predetermined percentages of oxygen and carbon dioxide has largely overcome this problem.

Through the knowledge of nitrogen levels obtained by leaf analysis, the fruit grower is able to have a better understanding of his orchard, and produce higher quality fruit with better storage characteristics.—C. A. EAVES, KENTVILLE, N.S.

LE CONTRÔLE DES COCHENILLES DE LUZERNE—Nous éprouvons de grandes difficultés à contrôler les cochenilles (mealybugs) sur les sélections de luzerne croissant en serre. Les insecticides ordinairement utilisés s'avèrent inefficaces malgré les essais répétés.—L. Dessureaux, La Pocatière, Qué. (maintenant à la Station de recherches, Ferme expérimentale centrale, Ottawa.)

FAIRVIEW RED RASPBERRY TRIALS—The red raspberry variety, Fairview, has been tested for several years in the Lower Mainland area of British Columbia. In 1965, and earlier, yields of attractively colored, large-sized fruit were relatively high. The fruit, which is less firm than that of Williamette, ripens late in the season, and this is a distinct handicap, since pickers are then sometimes hard to get.

Below-normal winter temperatures in 1964-65 injured red raspberry plantings in the area, and hot and dry weather during the 1965 growing season caused more damage. Fairview plants had almost as much winter injury as those of Williamette, and more than those of Sumner or Newburgh. Where root rot was severe on Williamette plants, it was slightly less so on those of Fairview.

All Fairview plantings have shown vigorous but very sprawly cane growth. Due to both factors, therefore, Fairview is not being recommended for commercial planting in B.C. However, because of its attractive fruit and high yield, it can be recommended for home gardens—particularly in sheltered locations.—H. DAUBENY, AGASSIZ, B.C.

NO MORE GREY SPECK IN OATS?—Control of grey speck in oats (a manganese deficiency) may be possible. In recent tests at the CDA Experimental Farm, Lacombe, Alta., manganese ammonium phosphate, a very slightly soluble salt, was added to a medium with which oat seed was pelleted.

These were given a mercuric seed treatment to protect the manganese from the action of manganese-oxidizing soil micro-organisms. This eliminated grey speck symptoms.

In 1964, yield increased about 25 per cent, and manganese content about 30 per cent.—B. BERKENKAMP AND D. K. McBEATH, LACOMBE, ALTA.

Soil borer: (A) rachet wrench with square socket; (B) and (C) drive rods; (D) extension rod; (E) drive and ejector rod; (F) core barrel.

SOIL BORER FOR SAMPLING IN PERMAFROST—Satisfactory results have been obtained from a soil borer designed by the CDA Engineering Research Service for sampling in permafrost. The borer was used to collect samples in frozen gravelly clay loams. The carbide-tipped teeth cut through shaly stones quite easily, and cores containing gravel and ice, or peat and ice, were collected and easily removed from the barrel. On these gravelly soils the full weight of the operator is required on the end of the borer. The grooves on the outside of the barrel were ineffective in bringing up the shavings, at least in clayey soils, since they became filled with sticky clay.

When drilling at depths greater than 12 in., the clean-out ports picked up some mud from the sides of the hole, but this in no way lessened the effectiveness of the borer. The borer is capable of working to a depth of about six feet or more, depending on the length of the extension rods used.

A full-scale plan showing details of construction and assembly is available on request from the CDA Engineering Research Service, Central Experimental Farm, Ottawa.—F. S. NOWOSAD, OTTAWA.

NEW WEED CONTROL EFFECTIVE—Bromoxynil, a new weed control chemical, has been under trial for the past two seasons at the CDA Experimental Farm, Lacombe, Alta. When 4 oz. per acre (active ingredient) were used on seedling tartary buckwheat, wild buckwheat, green smartweed, lambs quarters, stinkweed, and several other annual mustard species, more than 90 per cent kill resulted.

Seedlings in the 2 to 3 leaf stage under good growing conditions were much more sensitive than those in the 4 to 5 leaf stage, only 2 oz. per acre being required to kill them. However, plants beyond the 6-leaf stage were hard to kill, even when 6 oz. per acre was used. Hemp nettle, corn spurry and chickweed at all growth stages were highly tolerant. Mixtures (1 :1) of bromoxynil ester with MCPA or 2,4-D are possible, and they increase the effectiveness of certain species—especially hemp nettle.

Under controlled environment, seedling plants of tartary buckwheat and green smartweed were completely killed in about 48 hours. By comparison, 4 to 5 weeks were required to get similar results using dicamba or 2,4-D.

Wheat, oats and barley have shown very high tolerance to bromoxynil from emergence to the 6-leaf stage, applied at the rates given above.—H. A. FREISEN, LACOMBE, ALTA.

EVALUATION OF BROMEGRASS— Sixteen bromegrass strains were tested for their possibilities as new varieties over a 4-year period at the CDA Experimental Farm, Brandon, Man. Both length and consistency of performance were considered.

The results: First year, 23 to 26 per cent of the 4-year production; 2nd year, 34 to 41 per cent; 3rd year, 21 to 25 per cent; 4th year, 14 to 20 per cent.

The major variation in long-term performance occurred during the second and fourth year. The most variable strain ranged from a high of 41 per cent in the second year to a low of 14 per cent in the 4th year.

The most productive entries in this test also performed most consistently.—A. T. H. GROSS, BRANDON, MAN.

BARBERRY ERADICATION

1. Destroying barberry bushes with chemical spray.
2. Under surface of barberry leaf showing rust infection.
3. Rust infected leaves of common barberry.

New developments in federal participation respecting quarantine and eradication measures. No permits to be issued after April 1, 1966, for the importation of any deciduous species, hybrid or horticultural variety of barberry.

G. STUART BROWN

In May, 1964, agreements were signed between the governments of Canada, and Ontario and Quebec under which over a million dollars on a cost-sharing basis would be spent on eradication of common barberry, *Berberis vulgaris* L. Barberry on abandoned farms, permanent pastures, fence rows or any rural plot of land was to be treated with a recognized herbicide. At the same time, crews were to perform a door-to-door survey in the towns and cities, enforcing the removal of all common barberry bushes within a specified time.

Until these programs were put into effect, little attention was given to restricting the development and sale of other barberry varieties susceptible to stem rust, in spite of regulations prohibiting their importation and movement within Canada. It has been noted on numerous occasions recently that several agencies are promoting the propagation and sale of varieties which are not on the list approved by the CDA Plant Protection Division under the authority of the Destructive Insect and Pest Act and Regulations. Sections 113 and 114, Part I, of the Regulations as amended by

Mr. Brown is supervisor of surveys, CDA Plant Protection Division, Ottawa, and federal coordinator, Barberry Eradication Program.

P.C. 1965—1356, July 28, 1965, designate this authority and, in part, read:

"113 (1) Where an inspector finds or suspects that any plant, soil or container of a plant is infested or infected with any pest or disease, he may order the owner thereof, or the owner or occupier of the premises to

(a) destroy, treat or disinfect the plant.

114 (1) The cost of any destruction, treatment and disinfection carried out under section 113 and any damage resulting therefrom is the responsibility of the owner of the plant, soil or container so destroyed, treated or disinfected and the occupier of the premises on which the plant, soil or container was located."

Section 117 as amended under P. C. 1965—1356 authorizes the control of movement of plants under the Regulations and the Plant Protection Division is empowered to prevent the movement from any premises of any plants referred to in section 113.

Most horticultural and some wild barberry varieties stem from hybridization and, as a result, many which are resistant pose an additional threat. Many of the hybrid seeds produce plants that can be readily identified as susceptible but other plants from such seed are resistant. The seeds that these resistant plants produce may in turn produce both susceptible and resistant plants. Consequently, any variety, hybrid or species descended from common barberry or any other susceptible species must be eradicated if the programs in Ontario and Quebec are to produce the required results.

Co-operation has been solicited from commercial outlets in Canada in preventing distribution of susceptible barberry varieties and response has been gratifying in most instances. Door-to-door surveys in cities and towns have already been started and owners are advised to destroy susceptible plants. The latter include Sheridan Red, Humber Red, Cardinal, and other varieties and hybrids containing *B. vulgaris* in their parentage. However, more extensive measures will have to be taken and orders have been issued to Plant Protection Division specialists to require removal of these varieties, such orders to be enforced under Section 113, Part I, of the Regulations as revised, in all provinces of Canada.

Furthermore, no permits will be issued after April 1, 1966, for the importation of any deciduous species, hybrid or horticultural variety of barberry. Research has shown that many which have been considered practically immune are susceptible to certain rust races in some parts of the world. Even *B. thunbergii* is not immune to all of them. If new rust races were introduced to North America they could cause disastrous losses to the agricultural economy of Canada.

Questions will undoubtedly arise regarding the limitation of imports and interprovincial movement to evergreen varieties. We have removed *B. thunbergii* and its varieties from the approved list for the following reasons:

1. It is known to be susceptible to rust races prevalent in certain parts of the world. Its continued importation might bring one of these rust races to Canada with disastrous results.
2. Many of the susceptible varieties listed under *B. thunbergii* are indistinguishable from resistant varieties and have been substituted in nursery stock shipments from some countries. For example, we know that Sheridan Red has passed inspection listed as an approved variety of *B. thunbergii.*
3. Certain new hybrids are being listed as horticultural races of approved varieties and exported to Canada, when in reality they have susceptible parentage. Some even pass as *B. thunbergii* without a variety name.
4. *B. thunbergii* hybridizes readily with other varieties and a certain percentage of seed re-segregates to each parent. If the other parent is a susceptible variety this would seriously prolong our eradication program, as well as increasing its cost and causing additional crop losses.
5. Stem rusts are in a highly mutant state of evolution and it is logical to assume that a rust race might develop in Canada which could attack *B. thunbergii.*
6. Straw from Japan used as packing material was intercepted at a port of entry in Canada. Examination of this straw revealed apparently healthy stem rust spores. It is known that *B. thunbergii* is susceptible to at least one Asiatic stem rust race and entry of such a race might occur in this way.

The above points are true of almost all the deciduous varieties of barberry which were on our approved list of November 5, 1962. Consequently we have decided to refuse importation and interprovincial movement of all deciduous varieties when currently outstanding permits expire. This does not mean that we are going to require immediate removal and destruction of varieties on the approved list of 1962. However, within a few years we will require this. We cannot afford current losses to our cereal production but are faced with even greater losses if this action on barberry is not taken. •

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R. N. WENSLEY

Perennial canker has ravaged peach orchards in southern Ontario since the history of peach growing there has been recorded. Despite control recommendations of early workers, the disease has continued to be the main cause of reduced productive life of orchards. While some varieties, viz., Elberta, and July Queen, have shown some resistance, no variety has been found free from canker. The disease is caused by either of two fungi, *Valsa cincta* and *V. leucostoma*, the former being more pathogenic.

The orchardist may reduce canker in several ways, beginning in the first year of planting. Removal of infected trees or infected parts of a tree will remove sources of inoculum; elimination of stubs, die-back and dead wood, prevention of wounding and the practice of late spring pruning will reduce infection sites; proper fertilization and sowing of cover crops, respectively, will promote adequate growth and encourage hardening-off before the fall infection period begins. Many orchardists have demonstrated the effectiveness of these recommendations. However, the fact remains that other factors such as borer injury, bruising, or dead tissue caused by other diseases make peach prone to infection by canker fungi.

Our current investigations at the Harrow Research Station may contribute further to the control of peach canker. Sources of greater winter hardiness are being sought by the plant breeder. Entomologists are investigating varietal response to borer injury, and results indicate that certain varieties are more resistant than others. Also, a rapid rate of leaf abscission has been found to be related to higher canker resistance of some varieties.

Despite this progress several puzzling questions remain unanswered. What is the nature of resistance and where does it lie? Can we depend upon orchard testing for resistance in view of the variable results frequently obtained? What is the relationship between healing properties and canker resistance of peach?

Elberta, under orchard conditions, owes its resistance to the fact that wounds, which are necessary for infection, heal rapidly, and thus are exposed to infection for a shorter time. However, if infection is established, the canker will develop comparatively rapidly. This variety possesses orchard resistance. In Redhaven, on the other hand, wounds heal less rapidly and the fungus has greater opportunity for gaining entry. However, further development of the canker is slower than in Elberta. It would seem, therefore, that the performance of a variety depends upon the sum of its bark resistance and innate resistance to perennial canker.

The kind, depth, and time of wounding are important to canker development in a peach tree. We know from earlier work that the importance of the kind of wound may differ with season. As an example, leaf scars occur in the fall and may provide infection sites if healing is delayed. Similarly, other seasonal-type wounds occur, of which some may be avoided or reduced in number by good cultural practices. In a study of wounding methods, we found that infection developed in all wounds that penetrated the outer skin, but most rapidly at the deepest wounds. For example, we observed that wounds made by a hot awl, which causes more extensive damage to the tissues, provided a better infection site and favoured more rapid development of the canker.

The author is a plant pathologist with the CDA Research Station, Harrow, Ontario.

Perennial canker on limb of Elberta peach tree. Note sunken areas above and below exuding gum.

Wounding peach limb with 9 mm. steel borer. Wounds in the trunk, scaffold limbs and other limbs are used to study rate of healing.

Rate of healing of a wound is determined by measurement at periodic intervals throughout the season.

PERENNIAL CANKER OF PEACH IN SOUTHWESTERN ONTARIO

In field experiments, we found that the healing of wounds differed among peach varieties. Rate of healing was highest for relatively resistant-Elberta and lowest for the susceptible variety, Dixired. Consequently, natural wounds occurring in the orchard on Elberta may heal rapidly and thus escape infection, whereas the lower rate of healing on Dixired may leave wounds open to infection for a considerably longer period of time.

We found that the time of wounding was important to healing of all varieties. Healing was most rapid in July when temperature and hours of sunshine were highest. Thereafter, the rate diminished until at dormancy healing stopped. Wounds inflicted late in the season remained partly or wholly open and subject to infection. It was of interest to find also that rate of healing was lower on young branches than on main and scaffold limbs. Since canker is initiated on young branches as well as on older limbs, the importance of avoiding injuries particularly on the former is obvious. Fortunately, careful annual pruning in the spring may eliminate injured and infected branches and thereby prevent the establishment of perennial cankers and sources of inoculum within a tree.

It is obvious from the above that there is evidence of a relationship between bark characters and resistance, as well as between healing properties and resistance. We believe that the incorporation of both types of resistance in new peach varieties, in addition to other desirable characters including winter hardiness, resistance to lesser peach tree borer and other insect and fungus diseases, can be accomplished and thus provide effective control of perennial canker. •

EFFECT OF NITROGEN ON RHIZOME AND BUD DEVELOPMENT IN QUACKGRASS

G. I. McINTYRE

One of the most characteristic features of perennial weeds is their ability to spread and reproduce by means of buds on the underground parts of the plant. It is, indeed, the existence of these buds which makes perennial weeds so difficult to control.

In quackgrass (*Agropyron repens*), one of our most widespread and troublesome weeds, buds are produced on creeping underground stems known as rhizomes. These rhizomes grow horizontally just below the surface of the soil and may reach a length of several feet. Buds are formed at each node on the rhizome at intervals of about 1 inch. When the plant is growing undisturbed most of these buds remain dormant. If, however, the rhizome is broken up by cultivation many of the buds develop into shoots, from each of which several new rhizomes (usually 2 to 4) are soon produced. In this way, the plant is able to survive disturbance by tillage implements and the infestation is rapidly re-established.

Since this regeneration mechanism forms the basis of the weed's resistance to control, investigations at the Experimental Farm, Regina, are seeking to provide more information about the factors which determine the plant's capacity for rhizome production and which control the growth of the rhizome buds.

Previous investigators have established that the growth of the buds on the rhizome is controlled by the rhizome apex. If the apex is killed or experimentally removed there is an immediate stimulation of bud activity. This inhibition of lateral buds by the growing apex is known as "apical dominance" and occurs widely in plants. Although the underlying mechanism is still uncertain, it is generally assumed that bud growth is prevented by the action of a hormone produced in the dominant apex. There is, however, no evidence of such a mechanism in the quackgrass rhizome. Moreover, attempts to inhibit the growth of buds on decapitated rhizomes by the application of plant hormones have proved unsuccessful.

Thus, in the work at Regina, we are investigating the possible role of purely nutritional factors in bud development. This approach is based on the hypothesis that the rhizome apex may inhibit the growth of the buds by competing with them for the nutrient supply. Since nitrogen is the nutrient which is generally required in greatest amount, and the one which frequently limits growth in the field, we designed experiments to study the effect of controlled variations in the nitrogen supply. This was done by growing plants in the greenhouse in sand culture and providing them with a mineral nutrient solution containing known concentrations of nitrogen.

When plants were grown at a low nitrogen level, we found that the buds on the rhizome became dormant when only a few millimeters in length, just as they do in the field. If, however, an abundant supply of nitrogen was provided, the inhibiting effect of the rhizome apex was entirely eliminated and all of the buds grew out as lateral branches on the intact plant (Fig. 1). Chemical analysis showed that the rhizomes from low nitrogen plants had a nitrogen content similar to that reported for rhizomes collected in the field. This agreement suggests that nitrogen may be the factor which normally limits the growth of the rhizome buds under

Dr. McIntyre is a range weeds specialist, CDA Experimental Farm, Regina, Sask.

Quackgrass plants growing in trays of sand and supplied with (l. to r.) high, medium and low concentrations of nitrogen. (210 ppm., 10.5 ppm; 2.6 ppm. N. resp.) —1A

Rhizomes from same experiment showing effect of nitrogen supply on bud activity. —1B

natural conditions. It should be recognized, however, that in the field there are other factors which may limit the growth of the buds. We found, for example, in a more recent experiment, that variations in the supply of phosphorus had a similar regulating influence on bud activity.

In the course of these investigations, it became evident that the production of rhizomes was also affected by the nitrogen supply. In studying this effect more critically, we discovered that certain of the buds at the base of the shoot of the quackgrass seedling developed as rhizomes at low nitrogen levels (Fig. 2A); whereas, at higher concentrations (Fig. 2B), they developed as tillers (i.e. lateral shoots). Moreover, when plants were grown initially under conditions of nitrogen deficiency until the rhizomes had just emerged and the nitrogen supply was then increased, many of the young rhizomes were induced to turn upwards and develop into shoots. (Fig. 2C). While this control of bud and rhizome development was not complete (Table 1), the effect was sufficiently pronounced and reproducible to justify the conclusion that the nitrogen supply is a factor of considerable importance. Undoubtedly, however, there are other factors involved and further work will be needed before the underlying physiological mechanism is fully elucidated.

In considering the practical significance of these experiments, the results thus far obtained are of interest in suggesting the possibility of altering the growth and development of quackgrass in such a way as to render it more amenable to control. If, for example, the growth of aerial shoots could be promoted at the expense of rhizome production a herbicide treatment might then be more effective, not only because of the reduction in the number of rhizomes but also because of the increased leaf area to which the herbicide could be applied. It also seems probable that any treatment which is effective in stimulating the activity of the rhizome buds would be advantageous for there is evidence that buds which are actively growing are more susceptible to injury by a growth-regulating herbicide than those in a dormant condition. It has, in fact, been recently reported that the application of a nitrogenous fertilizer to quackgrass in the field increased the effectiveness of a subsequent herbicide treatment. This effect of nitrogen was tentatively attributed to the observed increase in leaf area and to a possible stimulation of rhizome bud activity.

There is thus good reason to believe that further research on the factors which control the behaviour of the buds on the roots and rhizomes of perennial weeds will lead eventually to more effective methods of control. •

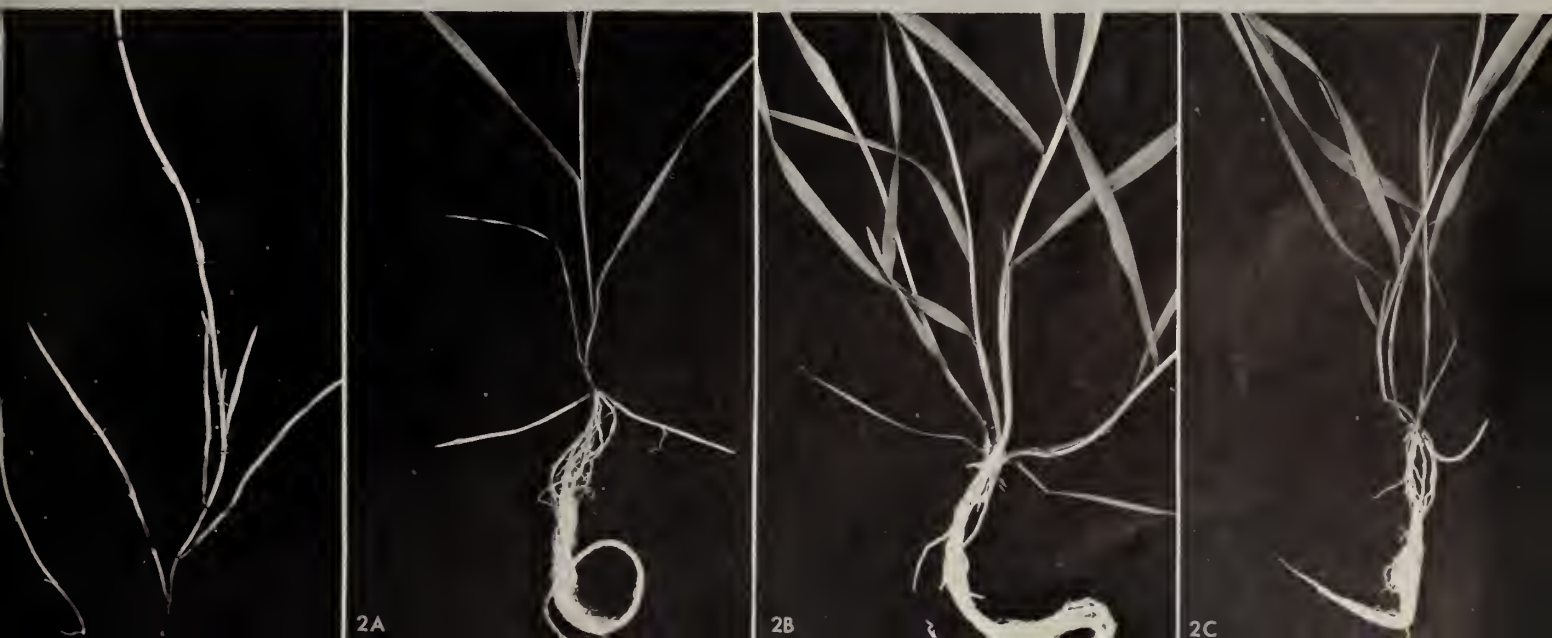
EFFECT OF THE NITROGEN LEVEL ON BUD AND RHIZOME DEVELOPMENT IN QUACKGRASS (AGROPYRON REPENS L. BEAUV.)

Nitrogen level	% buds developing as: Rhizomes	Rhizomes with terminal shoot	Tillers
Low (2.1 ppm N)	90	5	5
High (315 ppm N)	20	10	70
Low to High	42	47	11

Quackgrass seedling grown at low nitrogen level (2.1 ppm N.) showing young rhizomes produced from buds in axils of two oldest leaves.—2A

Plant grown at high nitrogen level (315 ppm. N.) showing production of tillers from buds in axils of first four leaves.—2B

Plant transferred from low to high nitrogen treatment shortly after emergence of rhizomes. Increased nitrogen caused many young rhizomes to turn upward and develop into shoots.—2C



sugar beet yields

SOUTH

L. G. SONMOR

Climatic records and soil survey data indicate that most irrigated crops presently grown in southern Alberta can be successfully produced with irrigation in the proposed South Saskatchewan River Development Project. Irrigation experiments, conducted on a 15-acre test area at Outlook by the Research Branch since 1950, have helped to confirm this observation.

In 1962 the Manitoba Sugar Company, in co-operation with the CDA Research Station, Saskatoon, Sask., initiated a series of practical research tests in order to obtain more comprehensive data on the potential yield and sugar content of irrigated sugar beets. (Numerous requests had been received by the Research Branch from government and private individuals concerning the feasibility of growing sugar beets in Saskatchewan under both irrigated and dryland cropping practices).

The results from early experimental tests made at numerous locations in Saskatchewan off and on between 1924 and 1946 indicated very wide fluctuations in yield and stand establishment under conditions of natural precipitation. The Experimental Farm tests at Rosthern, Melfort, Indian Head, and Scott reported yields ranging from 8 or 9 tons to 15 or 16 tons per acre, while the average yield from each of these four stations was 12.3, 8.5, 9.2, and 11.9 tons, respectively. The Saskatchewan Field Crops Branch also carried on sugar beet trials at 11 different locations in the area between Melfort and Nipawin from 1936 to 1938, inclusive. These yields were highly variable and averaged 11.9 tons per acre, with 18.0 per cent sugar. Some trouble was experienced with flea beetles, cutworms, and long periods of dry weather in these early tests.

A six-year summary of the irrigated sugar beet tests conducted by the CDA Research Branch at Swift Current and Saskatoon on the test area at Outlook, Sask., is outlined in Table 1. This specialty crop was grown under a variety of treatments during the 1950's and again for the past four years. These data indicate that yields of 14 to 20 tons per acre and sugar content of 14.3 to 19 per cent compare very favorably with the production figures for southern Alberta.

Various planting and harvesting dates were tested. The data in Table 1 show that an average yield of 14.5 tons was produced during a 135-day seed to harvest period. A yield of 17.8 tons per acre was obtained by extending the length of growing season only 10 to 14 days. This average 3.3 tons increase would return an extra $46.00 per acre if the crop was valued at $14.00 per ton. In these tests the shortest growing period was 124 days and the longest 161 days.

Although the young seedlings are susceptible to frost for a few days after emergence, they are somewhat resistant after the development of true leaves. Mature beets are not damaged by light autumn frosts. However, when the tops are severely frozen the beet roots may continue absorbing water without any further increase in sugar production. As a result, sugar content is low, as in the 1965 test.

In our investigation, we found that the addition of nitrogen and phosphorus fertilizers to the beets grown on the fine sandy loam soil at Outlook also produced

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Mr. Sonmor is a soils and irrigation specialist at the CDA Research Station, Saskatoon, Sask.

SASKATCHEWAN RIVER IRRIGATION PROJECT

a significant increase in yield. In 1955-56 the check plots yielded 11.6 tons as compared to 14.4 tons per acre when fertilized with 100 pounds of 11-48-0. In 1963, the addition of both phosphorus and nitrogen increased the average yield from 16.1 to 18.6 tons per acre.

Sugar beets require a constant supply of water throughout the growing season. Water use for maximum yield may vary from 18 to 25 inches, according to recent data published by the CDA Research Station, Lethbridge, Alta. The average May to September precipitation for the six years reported in Table 1 amounted to only 8.0 inches, which also coincides with the long-term average for this five-month period at Outlook. The balance of the water requirement needs to be provided by irrigation, usually in five equal amounts of $2\frac{1}{2}$ inches each. In the event that natural precipitation is not available for proper germination in the spring, the needed moisture is supplied by one or more light sprinkler applications.

Even though good yields and quality of beets can be obtained in the South Saskatchewan River irrigation project area, it is not likely that sufficient irrigated acreage or a market for beet sugar will be available here for another 10-15 years or more. Labor requirements for thinning and weeding beets are usually high unless the enterprise is carried out with modern mechanization. Careful timing of operations is necessary, such as spraying for flea beetle control in the seedling stages. Nevertheless, experimental data obtained to date on the yield and quality of this crop will enable both government and industry to make a better analysis of the future potential of special irrigated crops in Saskatchewan. •

TABLE 1—SUGAR BEET YIELDS (1955-65)—OUTLOOK, SASK.
IRRIGATED TEST PLOTS

Year	Treatment: Fertilizer	Planted/Harvested				Yield: Tons/acre	Sugar content: %	Sugar content: lb./ac.
1955–56	Check (no fertilizer)	Unavailable				11.6	16.0	3700
	33.5–0–0 (60 lb./ac.)					12.3	16.8	4130
	33.5–0–0 (120 lb./ac.)					12.9	16.6	4280
	16–20–0 (125 lb./ac.)					13.0	16.8	4370
	16–20–0 (250 lb./ac.)					13.4	16.6	4450
	11–48–0 (50 lb./ac.)					11.8	16.2	3820
	11–48–0 (100 lb./ac.)					14.4	15.4	4440
1962	16–20–0 (320 lb./ac.)	May	24	Sept.	25	12.2	16.9	4120
		"	24	Oct.	8	14.2	17.0	4850
1963	a) Check (no fertilizer)	May	17	Oct.	8	17.6	16.9	5920
		"	27	"	8	14.6	17.1	4990
	b) 11–48–0 (140 lb./ac.)	"	17	"	8	19.8	17.0	6730
		"	27	"	8	15.5	16.9	5250
	c) Same as (b), plus 165 lb./ac. 33.5–0–0	"	17	"	8	20.7	16.5	6840
		"	27	"	8	16.5	16.7	5500
1964	16–20–0 (150 lb./ac.)	May	8	Oct.	16	17.5	19.1	6690
		"	22	"	16	13.9	19.1	5320
1965	33.5–0–0 (85 lb./ac. plus 100 lb./ac.) 11–48–0)	May	10	Oct.	4	16.9	14.3	4840
	Average					15.33	18.85	5166

Above, left: Typical sugar beet roots grown at Outlook, Sask., in 1965.

Above, right: Field plot of sugar beets at Outlook, Sask. (Sunflower crop in background).

S. E. MAGWOOD

The thought of a chick hatching machine serving as a delivery room would make an obstetrician shudder. Clouds of dust bearing many microorganisms, some possibly disease-producing, are always present when chicks are hatched. Although the fluff and dust are inevitable, studies conducted at the CDA Animal Diseases Research Institute have shown how bacterial contamination of this material can be largely avoided.

These studies, which were reported in *Research for Farmers, Winter 1965*, showed that air-borne particles of dust and microorganisms fall on horizontal surfaces such as floors and tables and thus constitute a reservoir from which they become air-borne during employee activity. When drawn by fans into hatchers, these bacteria multiply rapidly on the nutritious fluids on the bodies of the emerging chicks. As chicks dry off, the dust and fluff particles from their downy coats, along with adhering organisms, are expelled with the air from the hatchers and fall on the floor. Thus is completed one cycle of a continuous process of contamination of each hatch of chicks from the environment. The degree of contamination of the chicks is directly related to the number of bacteria in the hatchery air. Under more sanitary conditions, where air-borne organisms have been reduced to a minimum, very few or no organisms are to be found either on the chicks or on the dust particles.

Our experimental findings indicate the need to minimize bacterial contamination in the hatchery environment, more particularly in those having sub-optimal sanitary conditions. Three large commercial hatcheries co-operated in a trial of such a program under practical conditions. Their sanitary status as judged by previous routine fluff tests was as follows: Good (S), Fair (P) and Unsatisfactory (SP).

For comparative purposes and to establish a base for evaluation of the results, we made initial determinations of the bacterial counts of the air and on the floor surfaces at each of the three hatcheries before the program was begun. Following the regular 'clean-up' after each hatch, the room floors were washed with a commercial detergent-sanitizer solution and the tables and counters were wiped with a similar solution. In addition, any other sources which could contribute to air-borne contamination, were located and eliminated. Bacterial populations of the air and floors (which we will call 'air counts' and 'floor counts' respectively) were determined on several occasions during the removal and processing of hatches when the counts were likely to be highest. Our results are shown in Figures 1-3. In each figure, the solid line joins the median value of the floor counts of the several rooms at each examination. The other curve, which represents the air counts, followed the same trend as the floor counts.

The initial bacterial counts at hatchery S were low, due to good plant design and sanitary practices, and these values were carried to even lower levels during the trial period. At hatchery P, the initial values were higher than at hatchery S; they fell in the early part of the trial, rose at the fifth test during extensive dust-producing renovations and then fell to lower levels again. At hatchery SP, a marked decline in the bacterial counts occurred after floor sanitizing was begun. When this procedure was suspended, the counts climbed to nearly their former very high levels but after the resumption of washing they dropped to moderate values.

In earlier field studies, we had observed that the bacterial populations on those surfaces which were regularly cleansed, such as hatcher trays and walls, were quite low at the end of hatching, even in those plants judged to be less sanitary. Despite the satisfactory sanitary state of the machines themselves, in those plants which had high air and floor counts, we found that successive lots of chicks hatched in these clean machines had very high bacterial counts on the fluff and dust. In contrast, we discovered that when these plants reduced environmental and air-borne contamination by a regular surface disinfection pro-

Dr. Magwood is with the Animal Pathology Division, Health of Animals Branch, CDA Animal Diseases Research Institute, Hull, Quebec.

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gram, chicks were hatched regularly without this marked increase in air counts.

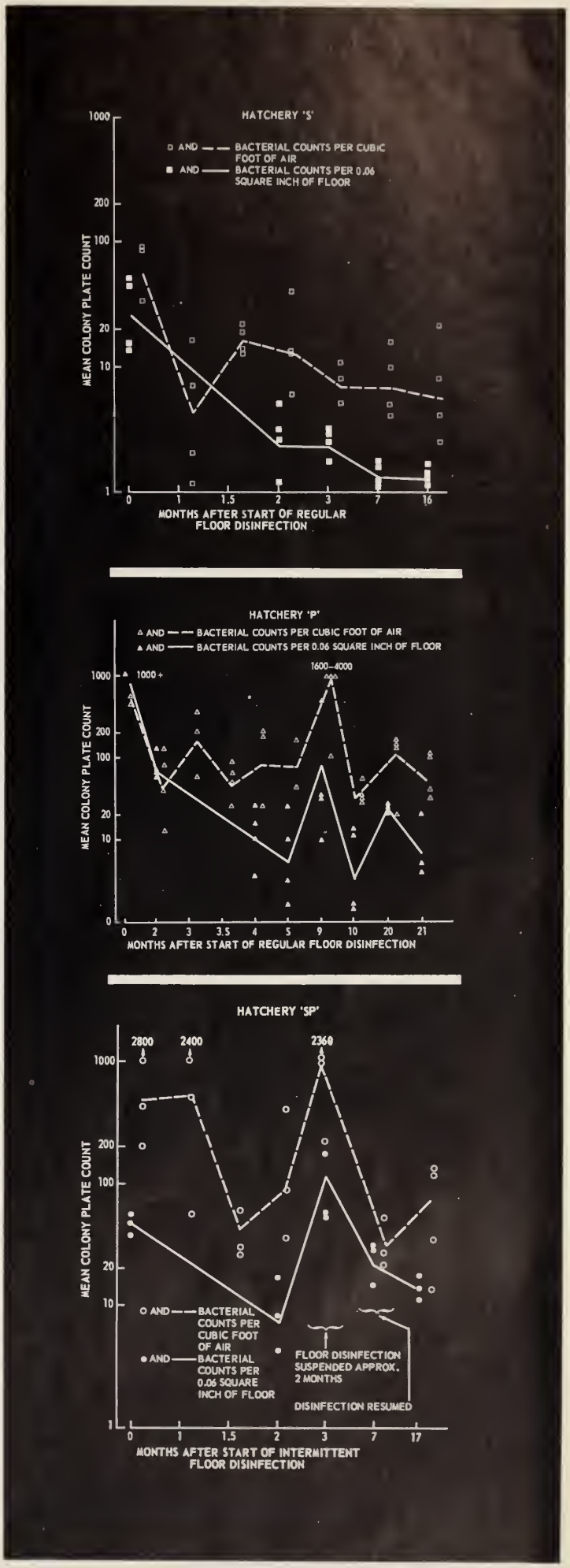
Thus, our experimental and field-trial evidence has established that air-borne organisms are a major source of contamination of hatching chicks. This effect is not surprising because the spread of pathogens and non-pathogens through the air has long been recognized.

The multiplication and spread of organisms that has been found to occur in hatcheries may be compared, apart from the chick fluff, to the conditions which existed in hospitals many years ago. Studies of the microbial ecology of hospitals have led to great reductions in their environmental 'counts'. Today an acceptable air count in operating and delivery rooms is approximately one bacterial colony per ten cubic feet of air.

In contrast, although the treatment enabled the hatcheries to reduce their air counts by 80-95 per cent, even these reduced populations were 20-1000 times greater than those in an operating room.

The very low air counts in hospitals have been achieved through the use of complex filtration systems and by specialized techniques about which a wealth of information is available from the field of hospital design.

Although many of the techniques may not be economically feasible for the average hatcheryman, a simple method such as sweeping away falling dust with an air current created by an exhaust fan located at floor level could readily be adopted by the industry. Commercial hatcheries may not achieve hospital-like conditions but the regular application of elementary good housekeeping practices and the use of a sanitizing agent were shown to be practical and effective measures for reducing the bacterial contamination of the hatchery environment. The essential approach to hatchery sanitation is that of overall biological cleanliness throughout the plant. •



Right: Effect of regular floor disinfection on bacterial populations of air and floor for three commercial hatcheries S, P and SP.

OULTRY HATCHERIES -CLEAN"?

advances in potato late blight resistance

Upper: Inoculating young potato plants to test blight reactions.

Lower: Three types of reaction after inoculation with late blight fungus: (left to right) high resistance; low resistance; susceptible.

L. A. DIONNE and W. A. HODGSON

Control of the late blight disease of potatoes with fungicides is a costly and not always dependable undertaking. Potato varieties with reliable resistance to this disease could save growers in the affected regions a large annual expenditure and thereby greatly reduce the cost of potato production.

Resistance to late blight is known to be of two types. In one, resistance is limited to particular pathogenic races of the disease-causing fungus. In the other, resistance is generalized and not specific to any race or races. Until recently, potato breeders have concentrated on producing varieties resistant to particular races of the fungus. However, the blight organism has shown itself to be extremely variable and the control achieved by breeding has proved to be transitory as each new resistant potato variety soon succumbed to a new race of the organism. For this reason, breeders have now focused their attention on resistance which is not directed against specific races of the fungus. This general type of resistance is usually known as field resistance and is present at low levels in a few commercial varieties which still require spraying to assure a satisfactory crop. A few European varieties have much higher levels of field resistance and some recently released Mexican varieties express this desirable characteristic to an even greater degree. The latter are sufficiently resistant to produce good crops under conditions where standard varieties fail to give any crop. Unfortunately, these highly resistant varieties are poorly adapted to Canadian conditions but improved strains with equal or greater resistance are being developed in Fredericton.

Our work has shown that high levels of field resistance to late blight are present in several wild potato species. However, transferring this resistance to cultivated potatoes has required new breeding techniques as well as new methods of testing the hybrids for blight resistance.

We now have exceptionally high levels of field resistance to blight in selections that have many of the attributes of commercial potatoes. These selections have high quality. They are also early and heavy yielding. Their only defect has been a susceptibility to a seed piece rot in some of the better selections. While this has never shown up in the field, it has been troublesome in the greenhouse. As this defect might be hazardous in commercial potatoes, the weakness will have to be eliminated before blight resistant varieties of this type are released.

Of the sources of blight resistance which we are

The authors are potato breeding specialists with the CDA Research Station, Fredericton, N.B.

using in our program, two have been of particular interest. Our most advanced material has been derived from the wild potato relative, *Solanum demissum*, from Mexico. This species has been used by many breeders as a source of resistance to specific races of the disease-causing fungus. Unfortunately, the breeding methods previously used have not favoured retention of the high levels of field resistance which are also present in this species. New techniques have, therefore, had to be devised to permit retention of the full level of field resistance of the wild species and to combine this with desirable economic qualities.

Another species to which we are giving much attention is *Solanum bulbocastanum*, also a native of Mexico. This species bears little resemblance to the common potato plant. It has a vine-like growth habit and small willow-like leaves. It also has small, star-shaped, creamy yellow flowers and its tubers are extremely bitter but some forms of the species are, for practical purposes, immune to all races of late blight. Many breeders have tried to make use of this potentially valuable resistance but because of the remote relationship of *S. bulbocastanum* to the cultivated species, all their efforts were frustrated. This barrier has now been overcome and hundreds of hybrids derived by combining this species with commercial potatoes have been obtained. Many of the hybrids have outstanding levels of blight resistance but are still wild and will have to be improved by further crossing to good commercial varieties. The process of improving them is slow and difficult because the early crosses have produced hybrids which are very sterile. However, a solution to the sterility problem has been found and progress with this source of resistance is now expected to be much more rapid. In the meantime, several other sources of resistance are giving encouraging results for the ultimate conquest of late blight.

When the potato breeding work was initiated in Fredericton, reliable laboratory tests for assessing field resistance to late blight were not available. The seedlings had to be screened for resistance by growing them under blight epidemic conditions in the field. As this could not always be assured, special efforts were directed to devising dependable tests for measuring levels of blight resistance under laboratory conditions. The tests which resulted from this work allow us to predetermine the blight resistance of hybrid populations before they are grown in the field.

With new sources of blight resistance, new breeding techniques and new methods of testing for resistance, the outlook appears bright that Canadian farmers will, in the not too distant future, be provided with potato varieties having sufficient blight resistance to be grown with little or no spraying for late blight control. •

(1) and (2): Plant and tubers of an advanced blight resistant potato hybrid derived by intercrossing wild potato species and cultured potatoes; (3) and (4): plant and tubers of a wild type, potato species hybrid, similar to that used in the development of the variety in (1) and (2).

INFLUENCE DU SUPERPHOSPHATE ET DU CHOIX DES MÉLANGES DANS LE RENDEMENT DES PRAIRIES

E. GODBOUT ET L. DESSUREAUX

L'importance de la fumure phosphatée sur les loams graveleux podzoliques a déjà été soulignée de façon spécifique dans des rapports d'expériences conduites entre les années 1932 et 1945. Un autre essai, poursuivi par la suite pour déterminer l'effet d'applications variées de superphosphate, sera relaté ici.

L'influence prépondérante de la luzerne dans les mélanges à foin devrait être encore mieux reconnue dans le Québec. Sa contribution dans les rendements herbagers sera démontrée dans le présent article.

L'expérience a été conduite sur un sol franc-graveleux St-André, qui n'avait reçu aucune fumure durant les six années qui ont précédé l'expérience et dont le pH variait entre 5.2 à 5.9. La perte par ignition variait de 5.9 à 7.2%, le contenu en phosphore soluble entre 25 et 43 p.p.m. de P^2O_5 et le potassium échangeable entre 0.005 et 0.019% K_2O.

Trois champs de 2/3 d'acre chacun furent utilisés. L'un fut semé en 1947, un autre en 1948 et le dernier en 1949. Un deuxième cycle fut entrepris en 1954, 1955 et 1956 dans les mêmes champs. Le premier champ lors du deuxième cycle dut être abandonné parce que le semis de 1954 avait manqué. La rotation était la suivante: orge grainée en première année, suivie de cinq ans de foin; et en septième année une récolte d'orge servait à déterminer l'effet des mélanges sur la fertilité du sol.

M. Godbout, Station de Recherches de la Pocatière, est spécialisé en herbicides. M. Dessureaux, autrefois de la Station de Recherches de la Pocatière, maintenant de la Station de Recherches d'Ottawa.

Chaque champ a été divisé dans une direction en trois grandes parcelles, répétées deux fois et contenant l'un des traitements de fumure suivants:

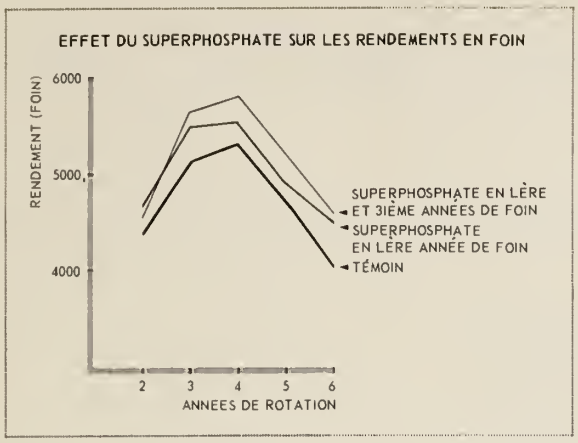
Témoin—16 tonnes de fumier à l'acre et 2 tonnes de pierre à chaux au départ de l'expérience qui furent appliquées sur toutes les parcelles.

A —500 livres de superphosphate ajouté en deuxième année de rotation.

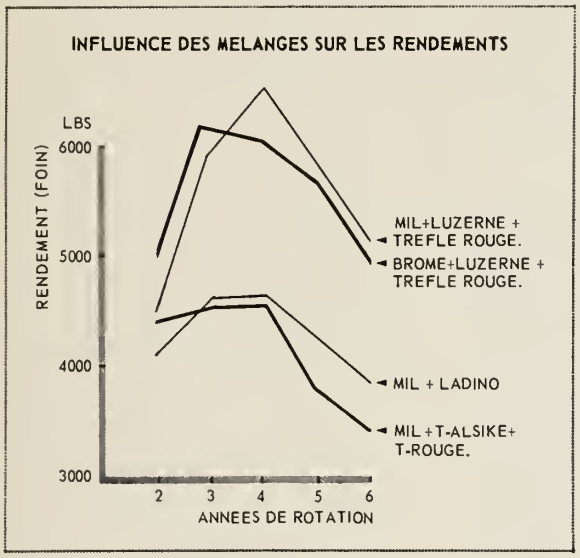
B —2 applications de 500 livres de superphosphate—l'une en deuxième année et l'autre en quatrième année de la rotation.

Chaque grande parcelle fut subdivisée dans l'autre direction en quatre parcelles de 18 x 60.5 pieds, contenant chacune l'un des mélanges suivants:

Mélange I	Mil	8 livres à l'acre
	Trèfle rouge	4 "
	Luzerne	6 "
Mélange II	Brome	8 livres à l'acre
	Trèfle rouge	4 "
	Luzerne	6 "
Mélange III	Mil	8 livres à l'acre
	Trèfle blanc Ladino	2 "
Mélange IV	Mil	8 livres à l'acre
	Trèfle rouge	4 "
	Trèfle alsike	2 "



Graphique 1



Graphique 2

L'engrais de ferme a été enfoui par le labour à l'automne, alors que la pierre à chaux était appliquée sur le labour et incorporée avec la herse à disques. Le superphosphate a été appliqué en couverture au départ de la végétation dans les deux cas.

Le semis des graines fourragères a été effectué à la main avant le passage de la herse à dents droites.

Deux coupes de foin par saison furent faites au cours du premier cycle, mais une seule coupe fut effectuée au deuxième cycle. Le pourcentage d'humidité fut établi au moyen d'échantillons pour permettre d'exprimer le rendement en matière sèche. Les dates moyennes de la première et deuxième coupe furent les 13 juillet et 5 septembre respectivement.

Le dispositif expérimental représentait un arrangement systématique répété deux fois avec distribution au hasard dans le sens des traitements ainsi que dans le sens des mélanges.

L'effet du superphosphate est illustré par le graphique 1. L'addition de 500 livres de super-phosphate à l'acre en première année de foin a causé une augmentation dans les rendements du foin qui a persisté à peu près également jusqu'à la fin de la rotation. Cette augmentation était légère, c'est-à-dire 6% en moyenne.

Une seconde addition de 500 livres de superphosphate en 3e année de foin a contribué à augmenter encore les rendements des trois dernières années de foin dans l'ordre de 4.3% en moyenne. Même les rendements de l'orge indiquent qu'une lègère influence des deux applications de superphosphate persistait.

La présence du fumier et de la chaux a contribué à restreindre la réponse des plantes fourragères et de l'orge aux additions de phosphore sur ce type de sol.

L'usage de la chaux et du fumier a été dans le cas présent le moyen le plus économique d'augmenter les rendements du foin. La hausse des rendements obtenus par l'addition de superphosphate n'a été guère suffisante pour justifier la dépense additionnelle occasionnée par l'achat et l'épandage du fertilisant.

Le dicton populaire est toujours vrai: le bon vieux fumier est encore le meilleur fertilisant.

L'influence des mélanges est illustrée par le graphique 2.

La présence de luzerne dans le mélange a contribué à augmenter considérablement les rendements de foin, surtout chez les prairies de deux ans et plus.

Si l'on compare le mil au brome, on constate que la différence dans les rendements de foin est faible. Le mélange à base de brome est légèrement supérieur à celui contenant du mil pour les deux premières années, mais cet ordre est interverti à partir de la troisième année.

Le mélange de mil et trèfle ladino a été plus faible en première année, mais a donné dans la quatrième et

cinquième année des rendements un peu plus élevés que le mélange mil, trèfie alsike et trèfle rouge.

Cette expérience démontre bien que la présence de la luzerne dans les mélanges est essentielle pour augmenter les rendements de foin surtout quand il s'agit de longues rotations.

Le tableau 1 résume l'état de fertilité du sol à la fin de la rotation tel qu'influencé par la composition des mélanges.

TABLEAU 1.—RENDEMENT MOYEN DE L'ORGE SUR PARCELLES CONTENANT DIVERS MÉLANGES LORS DES RÉCOLTES PRÉCÉDENTES.

Mélanges des récoltes précédentes	Rendement en orge
I	1500 livres
II	1518 "
III	1278 "
IV	1381 "

Les rendements d'orge ont été plus élevés de 17% sur les parcelles qui ont suivi les récoltes fourragères où la luzerne était à la base du mélange. La présence de la la luzerne dans le mélange a donc contribué à laisser le sol plus productif au terme d'une longue rotation.

L'étude du graphique 2 pose deux problèmes intéressants.

D'abord les rendements de foin en première année sont plus faibles qu'en deuxième année. Cette différence s'accentue fortement quand la luzerne fait partie du mélange. L'explication la plus plausible que l'on puisse donner pour ce décalage de rendement en première année réside dans l'influence déprimante de l'orge sur le semis des graines fourragères. En effet l'action compétitrice de la céréale sur la croissance des plantules de luzerne est un fait fort bien démontré par différents chercheurs. On a démontré récemment que le fait de couper l'avoine quand les grains étaient au stade laiteux plutôt qu'à maturité avait occasionné une augmentation dans le rendement du foin en première année avec ou sans fumure potassique et phosphatée. D'autre part dans une expérience conduite au Montana, le rendement des herbages n'a pas été affecté de façon significative par la présence de l'orge comme plante-abri. Il y aurait lieu ici d'établir des expériences dans le but de déterminer le meilleur traitement à donner au semis des plantes fourragères à base de luzerne, afin d'obtenir en première année un rendement comparable à celui de la deuxième ou troisième année.

Le second problème qui se dégage du graphique 2 est la diminution graduelle de rendement qui s'accomplit après la troisième année de foin. Les causes possibles sont nombreuses. Cependant l'on peut se demander dans le cas présent si l'addition annuelle de fertilisants pour compenser ce qui a été enlevé par la récolte de foin ne pourrait pas augmenter dans une certaine mesure le rendement des prairies en quatrième et cinquième année. Cependant l'addition de superphosphate en troisième année n'a pas réussi à altérer cette tendance, comme l'on peut le constater en examinant le graphique 1.

La présence de luzerne dans un mélange est une condition essentielle à l'augmentation des rendements de foin.

L'emploi de la chaux et du fumier de ferme dans les quantités requises est un moyen peu dispendieux d'obtenir des rendements de foin intéressants. De plus l'addition de superphosphate de temps à autre au cours de la rotation peut contribuer à augmenter quelque peu les rendements. •

PUBLICATIONS

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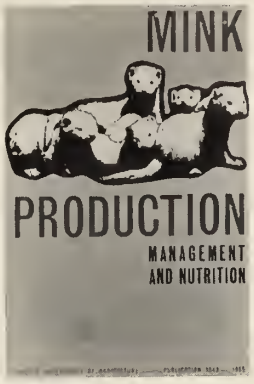
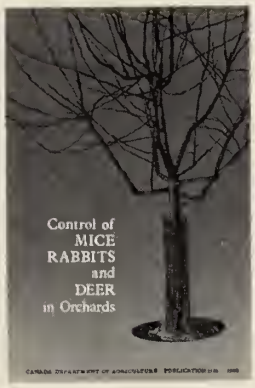


1043 MINK PRODUCTION 12 pp. 1965. Housing, feeding, selection and breeding. Based on "know-how" of successful breeders and experiments by Canada Department of Agriculture.

1043 L'ÉLEVAGE DU VISON 12 pp. 1965. Logement, alimentation, choix des reproducteurs. Brève étude fondée sur des réussites commerciales et les expériences effectuées par le ministère de l'Agriculture du Canada.



1115 CONTROL OF MICE, RABBITS AND DEER IN ORCHARDS 12 pp. 1965. Protection of trees from wild animals. Use of fences, traps, poisons and chemical repellents.

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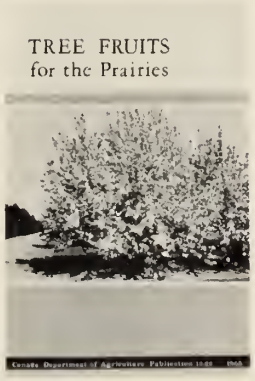

1222 TREE FRUITS FOR THE PRAIRIES 32 pp. Ill. 1965. Varieties to choose, how and where to plant. Orchard management under prairie conditions.

1222 TREE FRUITS FOR THE PRAIRIES 32 pp. Ill. 1965. Ne sera pas imprimé en français.

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